

NEWS



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ITALIAN SATELLITE TO BE LAUNCHED

The third spacecraft in a joint Italian-United States cooperative space program is scheduled to be launched by a four-stage Scout rocket from an Italian platform in the Indian Ocean three miles off the coast of Kenya, Africa, no earlier than April 24.

Called San Marco-C, the 360-pound (164 Kilograms) scientific spacecraft, built in Italy, carries three specially-designed instruments -- one Italian and two U.S. -- to study the environment of the upper atmosphere in the equatorial region.

The orbit planned for San Marco-C is equatorial, inclined only three degrees, with an apogee of about 500 statute miles (800 Kilometers), and a perigee of 130 statute miles (214 Km). It will circle the Earth once every 95 minutes. The launching will be conducted by an Italian crew.

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The San Marco program is jointly managed by the Centro Ricerche Aerospaziali dell' Universita Degli Studi di Roma (Aerospace Research Center of the University of Rome)--CRA-- of Italy and the National Aeronautics and Space Administration's Goddard Space Flight Center, Greenbelt, MD.

Under terms of the agreement signed in Nov. 1967, responsibilities for the program were divided as follows: Italy designed and built the spacecraft, integrated flight experiments and will conduct launch operations. The U.S., under the agreement, has provided the Scout launch rocket, two experiments, technical consultation, launch crew training. Both countries' facilities are involved in spacecraft tracking and data acquisition.

The first phase of the program--under an agreement signed May 1962--involved training Italian engineers and technicians at the NASA Wallops Station, VA. A series of sounding rocket launchings preceded the first San Marco launch from Wallops Dec. 15, 1964. Meanwhile, the San Marco platform was built and San Marco 2 was launched by an Italian crew using a NASA-provided Scout rocket April 26, 1967. Both satellites provided excellent data relating to atmospheric densities in the upper atmosphere.

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San Marco-C will be the third satellite launched from the San Marco platform. The second satellite, the U.S. Explorer 42 (the Small Astronomy Satellite-A), was successfully launched into orbit, by an Italian crew, on Dec. 12, 1970, the first U.S. satellite to be launched by a foreign country.

The launch facility, called San Marco, is a large platform of a type developed by the U.S. Armed Forces as an ocean dock. A second smaller platform called the Santa Rita which looks like a "Texas Tower" off-shore oil drilling rig, is located about 500 yards from the San Marco platform. It contains the control and operations center, range equipment and test rooms. The two platforms are connected by underwater cables.

The primary scientific objectives of San Marco-C are to obtain atmospheric drag, density, neutral composition and temperature data on the upper atmosphere.

Three distinct instruments are carried by the satellite, the primary one built by the Italian engineers and two additional instruments provided by the United States. Information obtained from these should enable scientists to understand better the complex mechanisms affecting the upper atmosphere and develop a more accurate model of the upper atmosphere.

Much remains to be learned about the Earth's upper atmosphere. It is a region where various types of particles, such as neutral atoms and molecules, ions, free radicals and electrons, interact with each other. Solar heating and other phenomena such as electromagnetic disturbances, create chemical reactions under conditions that are difficult, if not impossible, to reproduce in a terrestrial laboratory.

The advent of satellites has enabled scientists to carry out an intensive and systematic program of direct atmospheric studies not possible earlier. While these studies have greatly broadened our understanding of atmospheric behavior and composition, they have also pointed to little-understood changes which are occurring, perhaps as a result of atmospheric tidal motions and gravity waves.

Once in its equatorial orbit, San Marco-C will be tracked and data acquired by two key stations, one Italian and one U.S. The Italian station called Mobile Italian Telemetry Station (MITS) is located in Kenya at the San Marco Base Camp. Its job will be to serve the primary station for spacecraft control and data acquisition.

The U.S. station, located near Quito, Ecuador, will acquire data and serve as a backup to the MITS for spacecraft control. It is one of the stations of the NASA-operated Space Tracking and Data Acquisition Network (STADAN). A third station to be used for additional tracking support is the French National Center for Space Studies (CNES) at Kourou, in French Guiana.

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After evaluation by the principal investigators, the scientific results from San Marco-C, will be deposited in the National Space Science Data Center, Greenbelt, MD, for use by the world scientific community.

San Marco-C was built under auspices of the CRA in Rome. The Scout launch rocket is managed for NASA by the Langley Research Center, Hampton, VA. The rocket is built by Ling-Temco-Vought, Aerospace Corp., Dallas.

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NEWS



J. Watson

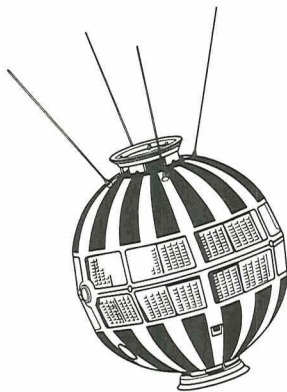
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PROJECT: SAN MARCO-C

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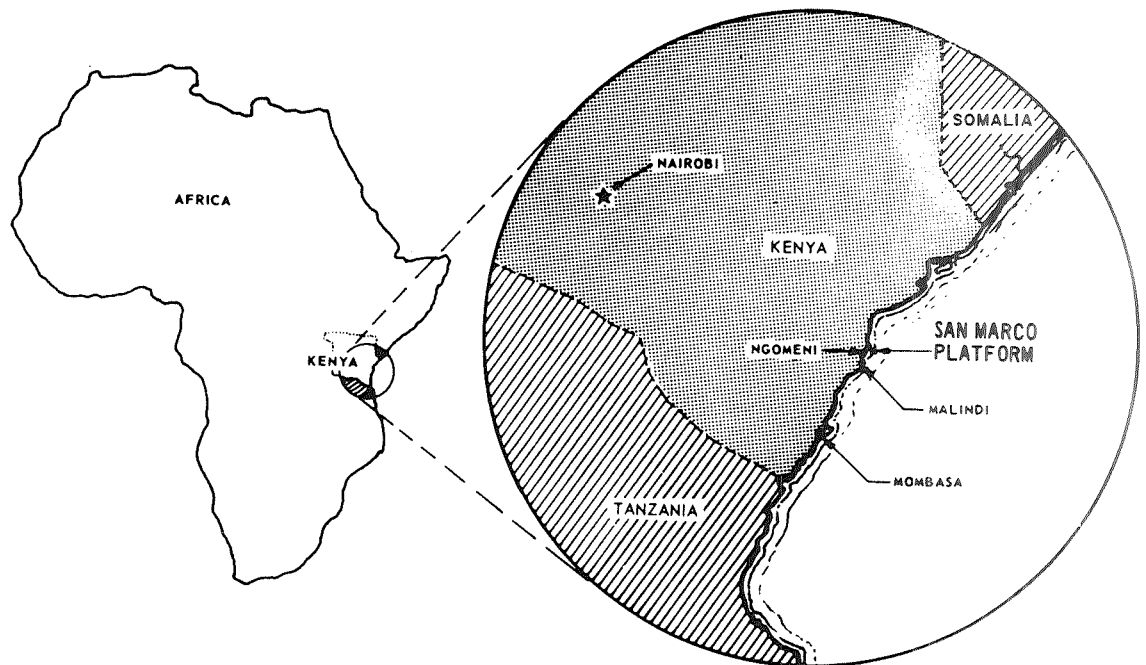
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(END OF GENERAL RELEASE: BACKGROUND INFORMATION FOLLOWS)

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San Marco Range Location



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THE SAN MARCO SPACECRAFT

The 360-pound, Italian-built San Marco-C spacecraft is a 30-inch-diameter sphere with four 19-inch antennas for command and telemetry transmissions protruding from its top. It is quite similar in construction to San Marcos I and II.

The spacecraft is unique in that the payload configuration consists of two masses separated by triaxial drag balance. One of these--the inner mass, containing all of the instrumentation, is heavier than the lighter, outer shell. The two masses are connected by triaxial flexing members.

When the spacecraft moves in orbit around the Earth, the outer sphere encounters the thin upper atmosphere and is retarded by this drag slightly. The heavier inner masses, however, continue moving unaffected by the drag working on the outer shell except for the forces transmitted by the flexible connections. This causes the distances between the outer shell and the "floating" inner core to change, depending on the amount of drag experienced.

Similar changes take place in the three flexible arms that connect the core and the shell. The precise degree of movement--actually the atmospheric drag--is measured by sensing devices and transmitted to ground stations on command by means of telemetry. A pneumatic caging system protects the drag balance mechanisms from excess loads during handling and launch.

The sensors for direct measurements of the neutral atmosphere are mounted 180 degrees apart on the middle inner structure of the spacecraft.

The spacecraft has a passive thermal control system to maintain a safe temperature ranging from about 32 degrees F to about 100 degrees F. Unlike earlier San Marco spacecraft, San Marco-C employs an attitude control system, a spin rate control system and solar panels mounted equatorially on the inner structure.

INSTRUMENTATION

Data obtained from the three especially designed instruments on San Marco-C should greatly enhance man's knowledge of the upper atmosphere and the dynamic changes which occur there as a result of seasonal, solar, magnetic and other effects.

The Drag Balance

This balance, an integral part of the satellite, was provided by the CRA. It will continue the drag force balance investigation carried by the first two San Marco spacecraft. Its operating technique is described on page 4.

Because of the sensitivity of the balance, precise measurements of short-period variations--such as daily density variations--can be obtained. Such measurements made in conjunction with the direct measurements, will help to determine the molecular temperature of the upper atmosphere and to determine molecular weights.

A critical factor in successful operation of the drag balance is that a stabilized spin rate of six rpm must be maintained. It will use three telemetry data channels.

Omegatron

This instrument provided by the NASA Goddard Space Flight Center and the University of Michigan, will make direct measurements of the temperature and distribution of molecular nitrogen in the path of the spacecraft orbit.

This unique 32-pound (15 kilograms) device operates on a principle similar to that of a cyclotron. It is automatically tuned to measure molecular nitrogen using sensor elements enclosed in a spherical chamber with a center line located in the equatorial plane of the satellite.

The motion of the chamber during satellite roll results in a variation of pressure in the chamber permitting measurement of nitrogen concentration and particle energy distribution to be made. Changes in the output current provide signals which are proportional to the temperature of the gas. The omegatron will be operated by six different ground commands. It will use three telemetry channels--one of which it shares with satellite housekeeping data.

Neutral Atmospheric Composition Experiment

The Goddard-provided Neutral Atmospheric Composition Experiment (NACE), a mass spectrometer device, which will make direct measurements of the density of constituents of the upper atmosphere--molecular nitrogen, molecular oxygen, atomic oxygen, argon and helium. The information obtained will provide insights into the complex mechanisms controlling the upper atmosphere.

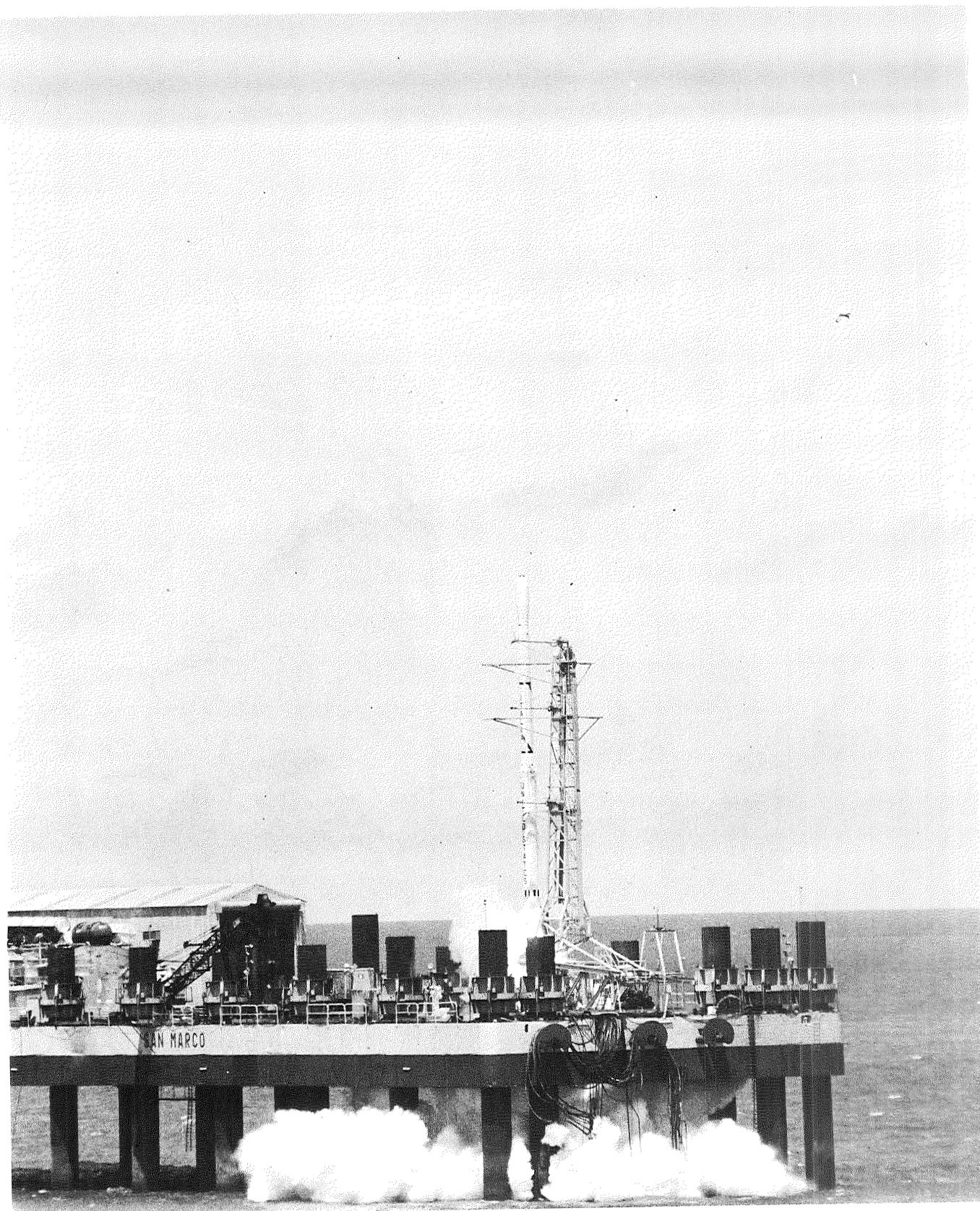
The device, which weighs 32 pounds (15 kilograms) is similar to mass spectrometers flown on NASA Explorer satellites 17 and 32--the Atmosphere Explorers--the first spacecraft devoted exclusively to the study of the neutral upper atmosphere

The operating principle of the NACE employs the double-focusing technique - it will provide nearly simultaneous measurement of the major components of the upper atmosphere. Its measurement capability is extremely precise.

The NACE is operated by seven commands and uses three telemetry data channels.

San Marco-C Experiments and Investigators

1. Drag Balance: Professor Luigi Broglio, Principal Investigator, Centro Ricerche Aerospaziali (Center for Aerospace Research), Rome.
2. Omegatron: Nelson W. Spenser, Principal Investigator, NASA Goddard Space Flight Center, Greenbelt, MD, and Co-investigator, George Carignan, University of Michigan, Ann Arbor.
3. Neutral Atmosphere Composition Experiment (NACE): George P. Newton, Principal Investigator, and David T. Pelz, Co-investigator, NASA Goddard Space Flight Center.



SAN MARCO-B LAUNCH, April 26, 1967

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SCOUT LAUNCH VEHICLE

Scout is NASA's only solid propellant launch vehicle with orbital capacity. The first-development Scout was launched July 1, 1960. The SM-C mission is expected to be the 73rd Scout launch. Since the Scout was recertified in 1963, the launch vehicle has attained a 94-per cent success record.

Scout B is a four-stage solid propellant rocket system. Scout No. S-173 and the spacecraft will be set on an initial launch azimuth of 90 degrees to obtain a 214x800-kilometer orbit with 2.9 degrees inclination and 94.8 minutes to complete one revolution.

The four Scout motors -- Algol II, Castor II, Antares II, and Altair III -- are interlocked with transition sections that contain guidance, control, ignition, and instrumentation systems, separation systems and the spin motors needed to stabilize the fourth stage. Control is achieved by aerodynamic surfaces, jet vanes and hydrogen peroxide jets.

The launch vehicle is approximately 73 feet (22.25 meters) long and weighs about 40,000 pounds (17,144 kilograms) at lift-off.

The Scout program is managed by NASA's Langley Research Center, Hampton, VA. The launch vehicle is built by LTV Aerospace Corp., Dallas. The San Marco launch complex is owned and operated by the Italian government and this Scout will be launched by an Italian launch crew.

Launch Facility

The San Marco launch facility is owned and operated by the Italian government. It is composed of two off-shore platforms stationed in Formosa Bay three miles off the coast of Kenya 2.9 degrees south of the Equator. The launch platform San Marco, is located 570 meters from the Santa Rita platform which houses the control and operations center and supporting range equipment. The platforms are connected by submarine control and power cabling.

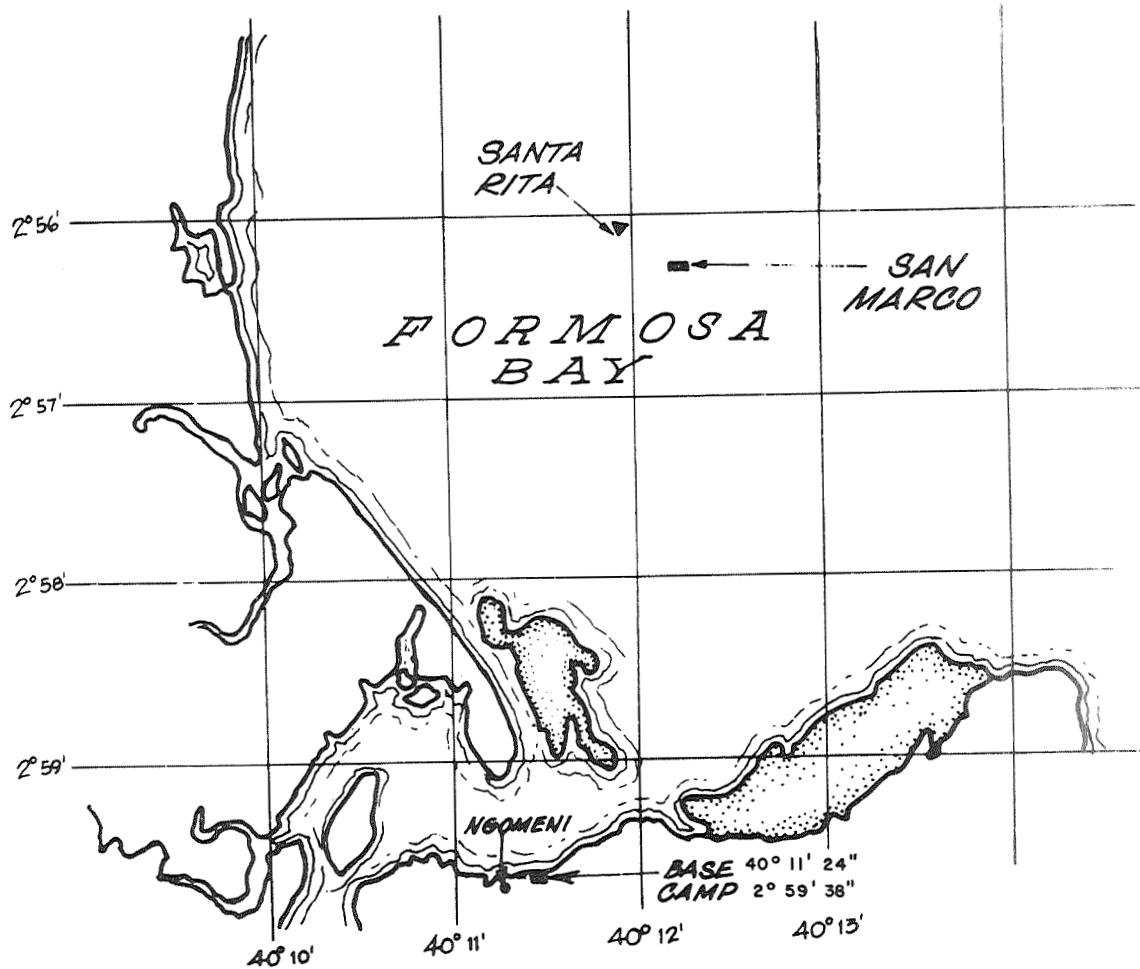
The launch platform has 20 steel legs firmly embedded in the sandy seabed at latitude 2 degrees 56 minutes 40 seconds South, longitude 40 degrees 12 minutes 47 seconds East -- ideal for equatorial space launchings. A 120-foot (36.5 meter) shelter, which houses the Scout vehicle during vehicle check-out prior to launch, provides an air conditioned environment for the vehicle while on the launcher. A large pit on the launch platform, open to the sea, will absorb the rocket exhaust of the Scout first-stage motor.

The Santa Rita platform, a LeTourneau oil drilling platform modified by the Italian firm Nuovo Pignone, contains the nerve center of the project, the control room, and houses the tracking and instrumentation required to launch and track the Scout.

There are 23 cables, linking the San Marco launch complex with its sister platform. Some idea of the complexity of the operation can be gained from the fact that there are more than 3,000 connections of various kinds linking the two platforms. Independent generators at the two locations produce electricity at two voltages to meet the requirements of the scientific equipment and the housing and other facilities.

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DETAILED MAP OF SAN MARCO RANGE FACILITIES



San Marco Platform - Scout Launch Facility
Santa Rita Platform - Range and Communications Control

LAUNCH AND ORBIT SEQUENCE OF EVENTS

The sequence of events from liftoff until the spacecraft is fully operational is as follows:

Launch Sequence

<u>Event</u>	<u>Time (seconds)</u>
Liftoff	0.00
First stage burnout	77.22
Second stage ignition	83.56
Second stage burnout	123.97
Third stage ignition	147.96
Third stage burnout	184.65
Spin-up	379.70
Third stage separation	381.20
Fourth stage ignition	386.05
Fourth stage burnout and orbital injection	421.13
Spacecraft separation	711.20

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SAN MARCO-C FACT SHEET

Launch: From the Italian Equatorial Range, San Marco Platform in Indian Ocean three miles off the coast of Kenya.

Launch Rocket: Four-stage Scout B rocket, Number S-173C.

Orbit: Apogee: 500 statute miles. (800 Km)
Perigee: 130 statute miles. (214 Km)
Period: 95 minutes
Inclination: 3 degrees to the Equator.

Spacecraft Weight: 360 pounds (164 kilograms)

Main Structure: Sphere, 30 inches in diameter

Appendages: Four antennas, 19 inches long.

Power System: 32 panels of solar cells mounted on outside of spacecraft sphere to provide power to charge two nickel-cadmium batteries plus a standby mercuric oxide battery.

Communications and Data Handling System: A 10-channel, pulse amplitude modulation (PAM)/frequency modulation (FM)/phase modulation (PM) system. System includes three subcommutated channels and two redundant telemetry transmitters. Transmitting frequency is 136.74 MHz. Transmission is by command only.

Command System: 43 command capacity.

Tracking and Data Acquisition: Mobile Italian Telemetry Station (MITS), Kenya. Quito, Ecuador station of the Goddard Space Flight Center's Space Tracking and Data Acquisition Network (STADAN) with additional tracking support from the CNES station at Kourou, French Guiana.

Operating Lifetime: More than six months.

SAN MARCO-C PROJECT OFFICIALS AND CONTRACTORS

National Aeronautics and Space Administration

Program Manager	John R. Holtz
Deputy Program Manager	Raymond Miller
Program Scientist	Dr. Erwin R. Schmerling
Scout Program Manager	Paul Goozh

NASA/Goddard Space Flight Center

Project Manager	Anthony J. Caporale
Project Scientist	George P. Newton
Project Coordinator	M.D. Handegard
Tracking and Data Systems Manager	Thomas Ryan

NASA/Langley Research Center

Project Manager	Roland D. English
Head Scout Technical Operations	S. J. Ailor
Head Scout Operations	L. R. Foster
Launch Operations	C. W. Winters

Centro Ricerche Aerospaziale (CRA)

Prof. Luigi Broglio	Director CRA
Prof. Carlo Buongiorno	Project Coordinator
Prof. Giorgio Ravelli	Spacecraft Manager
Prof. Michele Sirinian	Range Manager